Individual Perceptions of Air Pollution Exposure and Associated Health Outcomes in a Low-Income Cohort in Mysore, India

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Introduction

An extensive body of research has demonstrated that air pollution exposure is associated with a wide array of adverse health outcomes.

- Reduced lung function / respiratory diseases
- Cardiovascular disease
- Increases in hospitalization
- Premature mortality

Urban air quality remains a major concern for both public health officials and the general public, particularly in developing countries where baseline exposures are high, and income inequality may exacerbate health disparities attributable to air pollution exposure. In India, air quality public awareness campaigns are major efforts of governments at every level.

Yet, our understanding of relationships between ambient air pollution exposure, public perceptions of air quality, and concerns about associated health risks is incomplete.

Methods

Figure 1: India and Mysore

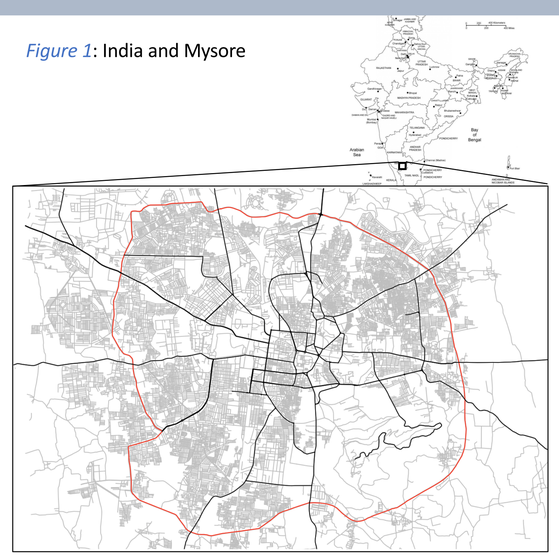
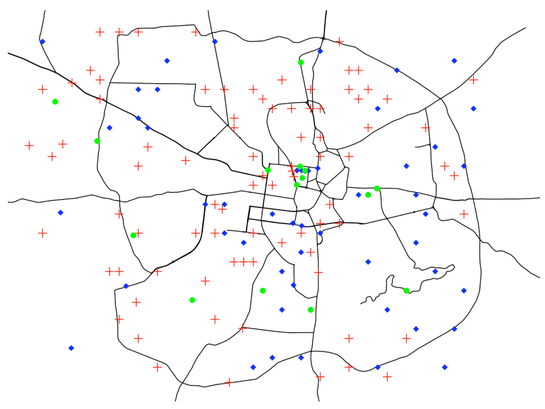


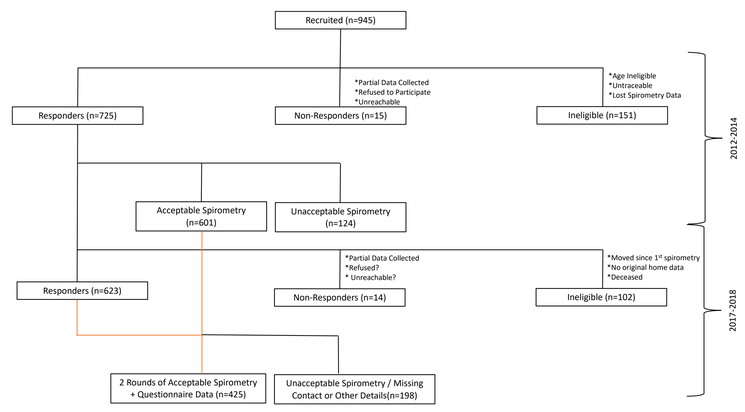
Figure 2: Mysore Sampling Sites; + Single sampler sites; ◆Duplicate Palmes tubes;● Duplicate Ogawa badges



Using the roads, buildings, land uses, and the pilot air pollution data, 150 sites were selected for seasonal air pollution sampling. Seasonal sampling was conducted at these sites during 2016-2017, to assess the temporal as well as spatial differences in air pollution throughout the city. LUR and Universal Kriging models were built to provide a spatially resolved estimate of air pollution exposure around Mysore.

In 2012-2014, members of the community were randomly selected for potential inclusion in the Burden of Obstructive Lung Diseases (BOLD) international study, which aims to estimate the population level prevalence of Chronic Obstructive Pulmonary Disease (COPD), asthma, and other lung health issues. The members of this cohort who had not moved between 2012-2017 were resampled for my dissertation work, to assess the relationship between long-term lung function decline and NO_2 exposure. Figure 3 below shows the study recruitment, and Figure 4 shows the map of air pollution exposure, along with the home locations of the cohort members.

Figure 3: Cohort recruitment waves, and final numbers within the cohort



During the collection of air pollution and health data, every member of the cohort was asked a series of 7 qualitative yes / no questions to assess self-efficacy with respect to air pollution exposure within their communities:

- The air pollution levels in my HOME neighborhood are worse than the air pollution levels in nearby neighborhoods in Mysore.
- It is important to me that the air pollution levels in my HOME neighborhood should not affect my daily routine.
- I believe that my health has been affected by air pollution levels in my HOME neighborhood.
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- I believe that I have access to care that can help me to overcome the effects of air pollution in my HOME neighborhood.
- I believe that I can reduce the effects of air pollution levels in my HOME neighborhood through my actions.
- I believe that my community has the ability to work together to bring down the level of air pollution in our HOME neighborhood.

Survey Results, and Implications for Self-Efficacy

A total of 623 qualitative survey responses were collected for inclusion in the qualitative component of this research. Figure 4 shows the home locations of the survey respondents, as well as the corresponding modeled air pollution exposure. Table 1 provides important summary statistics about the cohort members, including indicators of income and education.

Figure 4: Annual average NO_2 levels and locations of cohort members (cohort members diagnosed with COPD or Asthma are shown in purple, and cohort members without illness or medication are shown in blue)

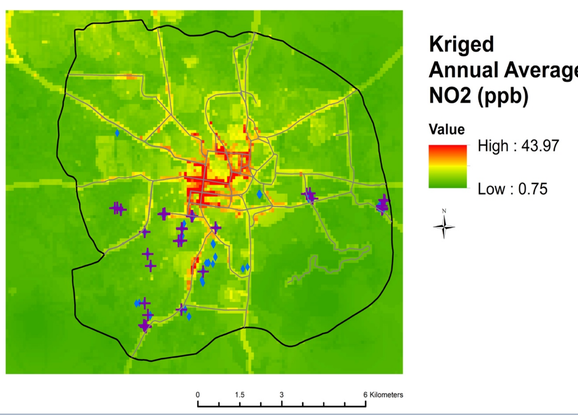

Table 1: Cohort Summary

Characteristic, n=623	Percentage or Mean (Standard Deviation)		
Gender (% male)	50.3		
Age (Years) at Enrollment	45.6 (6.4)		
Ever Smokers (%)	14.8		
COPD / Asthma prevalence (%)	10.8		
Cooking Fuel			
LPG	99.5		
Biomass / Other	0.5		
Indicators of SES			
Monthly Income, INR (USD)			
<6000 (<$85)	1.8		
6000 to <40,000 ($85 to <$565)	73.8		
40,000 to <4,00,000 ($565 to <$5650)	23.6		
>4,00,000 (>$5650)	0.8		
Education Level	Self	Paternal	Maternal
No Education	7.7	32.7	62.1
Lower Primary (1st – 5th Standard)	14.3	26.5	25.4
Upper Primary (6th – 7th Standard)	18.3	22.2	7.4
High School (8th - 10th Standard)	29.4	13.8	4.2
Higher Secondary (11th - 12th Standard / +2)	10.6	2.2	0
University or higher	19.7	2.6	0.9

In our study population, half of the respondents were living in areas at or above the annual average NO2 level recommended by the WHO for health protection. We found that *30 percent of the respondents believed that the air pollution in their own neighborhood was worse than the pollution in nearby neighborhoods*, and ***80 percent of respondents believe that the air pollution levels in the city of Mysore have been detrimental to their own health***.

Interestingly, only *1.5 percent of respondents prioritized minimizing disruption of their daily routine due to air pollution*. This may indicate that the members of this community living with very low income have other important priorities, such as food and steady wages, that overwhelm the importance of air pollution levels in their day to day lives.

Finally, we found that despite the high level of concern regarding air pollution exposures, *less than 1 percent of survey respondents believed that they could act individually or collectively within their community to reduce the impacts of their pollution exposure*.

Overall, the members of this community exhibit high levels of concern about their air pollution exposure; however, they seem to face issues of self-efficacy.

Limitations and Future Work

Mysore, population 1 million as of the 2011 Census of India, is a rapidly developing urban center in south India, with a rapidly industrializing economy. Income disparities are expanding in the city as accelerating development occurs, but Mysore is often seen as a model city for low air pollution levels and overall good health. Our study shows that areas of the city consistently exceed NO_2 levels recommended by the WHO for health protection; we further show that those members of the population living in some of the lowest income communities, with high levels of pollution exposure, are aware of this growing problem. We further show that members of the population have low belief in their ability to individually or collectively mitigate pollution exposure within their home environment. This has important implications for future research, educational campaigns, and interventions to reduce the health effects of air pollution exposure.

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